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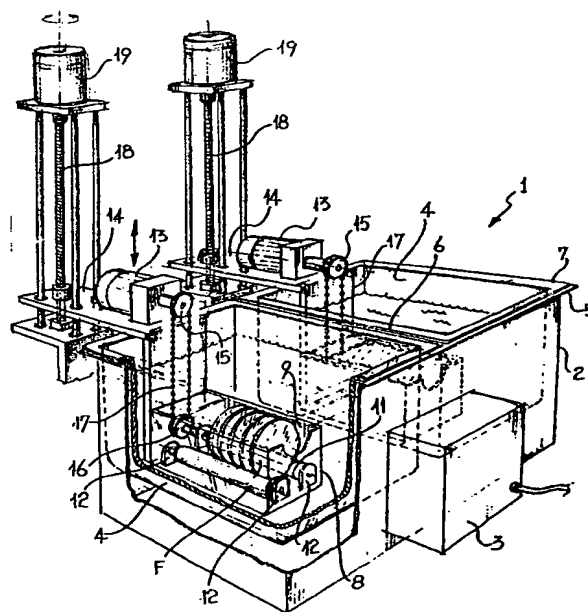
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### (54) Apparatus for wet processing of semiconductor wafers

(57) The equipment for the wet treatment of round semiconductor slices comprises a treatment tank containing a treatment liquid, a pair of parallel rollers with horizontal axis supported in a rotating manner near the bottom of the treatment tank and motor means for rotation of at least one of said rollers.

For treatment of the slices they are positioned on the rollers side by side with virtually horizontal axis parallel to the axis of the rollers.



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## Description

The present invention relates to equipment for wet treatment of semiconductor slices and specifically for wet washing or etching.

In the production of electronic semiconductor components the material (usually silicon) is cut in the form of discs called commonly slices from which are subsequently cut portions for the production of the various semiconductor devices. Normally the slices must be subjected to etching with various substances to obtain specific characteristics and sometimes they are also subjected to a washing step to remove from their surface traces of foreign substances such as for example ink applied in preceding steps to mark the slices.

Wet etching or washing takes place normally in accordance with one of the following procedures.

A first possibility is to place each slice on a basket and immerse the basket with the slice in the liquid necessary for etching or washing. In the latter case in particular the washing liquid is normally ethylene glycol to which are transmitted ultrasonic vibrations.

A second possibility is to place the slice on a rotating mandrel and flood it with an etching or washing liquid for a predetermined period.

In either case there are imperfections in the treatment due to the resting of the slice against the basket or mandrel.

The problem underlying the present invention is to make available equipment which would permit performance of wet etching and washing of semiconductor slices in a more effective manner.

Accordingly the present invention concerns equipment for wet treatment of round semiconductor slices comprising a treatment tank containing a treatment liquid and characterised in that it comprises a pair or parallel rollers with horizontal axis supported in a rotating manner near the bottom of the treatment tank and motor means for rotation of at least one of said rollers for treatment with the slices positioned on the rollers side by side with axis virtually horizontal and parallel to the axis of the rollers.

The rollers thus serve to support a plurality of slices arranged vertically side by side. By rotating the rollers the slices are made to roll in the treatment liquid to help uniform and effective treatment. Specifically there are no areas or points in permanent contact with support elements where the treatment takes place with difficulty. Furthermore the vertical arrangement of the slices permits simultaneous treatment of a high number thereof thus shortening treatment times.

The treatment liquid will be different depending on the treatment type. Specifically appropriate acids will be employed to obtain etching of the slice or ethylene glycol for ultrasonic washing.

Preferably the rollers have a perfectly smooth external surfaces. This prevents accumulation on the rollers of substances which might soil the slices.

Preferably the motor means comprise a gearmotor and a belt transmission active between the gearmotor and at least one of the rollers. Indeed, the rollers immersed in the treatment tank liquid must be connected with the gearmotor placed for practical and safety reasons outside the tank. The solution of a belt transmission ensures both simplicity and hence reliability and the desired separation of rollers and gearmotor.

Advantageously to ensure correct positioning of the slices on the rollers there is provided a cage for treatment of the slices in position on the rollers.

Preferably the rollers, the gearmotor unit and the belt transmission are supported by the cage. Said components are thus easy to withdraw from the treatment tank all together.

Preferably there are also provided second motor means for vertical movement of the cage both for introduction into and withdrawal from the treatment tank and for reciprocating vertical movement of the cage in the treatment tank during treatment. This permits making the movement of the slices in the treatment liquid more articulated thus helping better flow of the liquid over the total area of the surface of the slices.

If the treatment is ultrasonic washing the equipment comprises advantageously an external tank containing water and connected to ultrasound generation means with the treatment tank being immersed in the external tank.

Further characteristics and advantages of equipment in accordance with the present invention are clarified by the following description of a preferred embodiment thereof given with reference to the annexed drawing which shows a partially cross sectioned perspective view of ultrasonic washing equipment. It was chosen to exemplify said equipment because it is more complete and comprises all the elements of wet etching equipment plus other specific elements.

In the FIGS. reference number 1 indicates as a whole equipment for ultrasonic washing of round semiconductor slices and specifically silicon and indicated collectively by F.

The equipment 1 comprises an external tank 2 of generally parallelepiped form. To the external tank 2 is applied an ultrasound generator 3 of known type and therefore indicated only schematically in the figure.

In the external tank 2 are inserted in a removable manner internal treatment tanks, e.g. two internal tanks 4. There could also be provided a single internal tank or three or more.

The external tank 2 is metallic and full of water while the internal tanks 4 are of quartz and full of a washing liquid such as ethylene glycol.

The internal tanks 4 are also basically parallelepiped in form and housed in the external tank 2 in a suspended manner. For this purpose the external tank 2 is provided with an upper supporting edge 5 integrated with a supporting cross-piece 6 coplanar with the upper supporting edge 5 and extending across the external tank 2 while the internal tanks 4 are provided with a projecting upper

edge 7. The internal tanks 4 rest with the projecting upper edge 7 on the upper supporting edge 5 and on the supporting cross-piece 6 of the external tank 2.

In each of the internal tanks 4 is housed in a removable manner a cage 8 i.e. a parallelepiped structure open at bottom and top. The cage 8 is provided with guide and holding means to hold the slices in a vertical position side by side. Said means comprise a plurality of grooves 9 formed in the walls of the cage 8.

In the lower part of the cage 8 is housed a pair of cylindrical rollers 10 and 11 arranged with mutually parallel and virtually horizontal axes. For this purpose the rollers 10 and 11 are mounted on pairs of brackets indicated collectively by 12. Both the rollers 10 and 11 have perfectly smooth external surfaces and are made of Teflon®.

The roller 10 is mounted in an idling manner on its brackets 12 while the roller 11 is provided with motor means. The motor means comprise a gearmotor 13 mounted on a shelf 14 integral with the cage 8 and a belt transmission between the gearmotor 13 and the roller 11. More specifically the belt transmission provides a pulley 15 mounted on the output shaft of the gearmotor 13 and a pulley 16 mounted integrally and coaxially with the roller 11 and a belt 17 mounted on the two pulleys 15 and 16. The belt 17 is the so-called matchboarded type and thus comprises a plurality of matchboards (of Teflon® or equivalent) constrained to a central cable (of Nylon® or equivalent) and spaced a predetermined pitch apart.

The assembly formed by the cage 8 and the shelf 14 is vertically movable in the internal tanks 4 driven by second motor means comprising a worm-gear elevator 18 operated by a second gearmotor 19.

With the equipment 1 washing of slices F from which must be removed traces of ink or other (not shown in the figures) takes place in the following manner.

The slices F are loaded in the cage 8 in virtually vertical position side by side with virtually horizontal axis and guided in the grooves 9. The slices F are thus rested on the rollers 10 and 11.

The operation of loading cage 8 can be performed either with the cage 8 withdrawn from the internal tank 4 or with the cage 8 already immersed in the washing liquid contained in the internal tank 4.

If the slices F to be washed are loaded outside the internal tank 4 the cage 8 (with the motor means mounted on it) is immersed in one of the internal tanks 4 and inserted in turn in the external tank 2 by operating the second gearmotor 19.

When the load of slices F is immersed in the washing liquid the ultrasound generator 3 is activated. The ultrasonic vibrations are transmitted from the ultrasound generator 3 to the walls of the external tank 2, to the water, to the walls of the internal tank 4 and to the washing liquid.

Simultaneously there is operated the gearmotor 13 which rotates the roller 11 and with it the slices F rested

thereon. The idling roller 10 contributes only to support of the slices F.

Again simultaneously, there is operated alternately in both directions the second gearmotor 19 so as to give the cage 8 with the slices F to be washed a reciprocating vertical movement.

It was observed that the movement of the slices F during application of ultrasounds helps uniform transmission of vibrations from the washing liquid to the slices thus facilitating detachment of particles of ink from said slices F.

In this manner there is achieved more thorough and faster washing. Simultaneous operation on a relatively high number of slices F also contributes to rapidity of washing.

In case of treatment different from ultrasonic washing the equipment is simplified by elimination of the external tank necessary for ultrasound application. Naturally the material of the treatment tank would be different depending on the treatment liquid to be contained.

For etch treatments with acid substances it is advantageous to be able to insert and withdraw mechanically the slices from the treatment tank thanks to the elevator without the risk of splashing for the operator.

## Claims

1. Equipment for wet treatment of round semiconductor slices and comprising a treatment tank containing a treatment liquid and characterised in that it comprises a pair of parallel rollers with horizontal axis supported in a rotating manner near the bottom of the treatment tank and motor means for rotation of at least one of said rollers with the slices positioned side by side on the rollers with axis virtually horizontal and parallel with the axis of the rollers.
2. Equipment in accordance with claim 1 in which the rollers have a knurled external surface lengthwise.
3. Equipment in accordance with claim 1 in which the motor means comprise a gearmotor and a belt transmission active between the gearmotor and at least one of the rollers.
4. Equipment in accordance with claim 1 comprising a cage for holding the slices in position on the rollers.
5. Equipment in accordance with claims 3 and 4 in which the rollers, the gearmotor unit and the belt transmission are supported by the cage.
6. Equipment in accordance with claim 5 comprising second motor means for vertical movement of the cage both for introduction in and extraction from the treatment tank and for reciprocating vertical movement of the cage inside the treatment tank during the treatment.

7. Equipment for ultrasonic washing of round semiconductor slices in accordance with claim 1 comprising an external tank containing water and connected to ultrasound generation means with the treatment tank immersed in the external tank.

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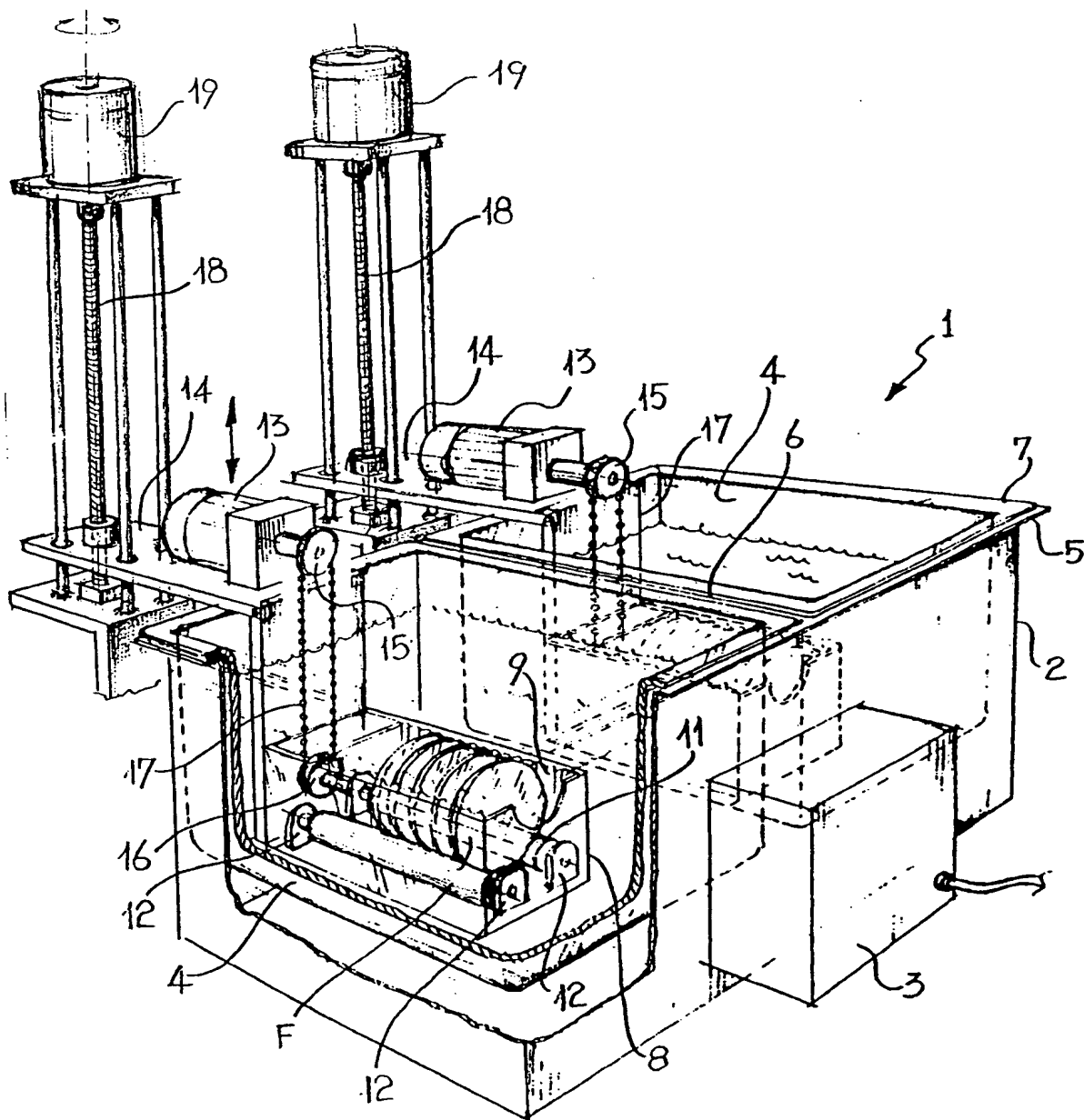
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# EUROPEAN SEARCH REPORT

Application Number  
EP 94 83 0389

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP-A-0 481 723 (SHIN-ETSU HANDOTAI) * the whole document *	1,3,4	H01L21/00
X	US-A-4 897 369 (SGS) * the whole document *	1,3-5	
A	US-A-5 279 316 (MIRANDA) * column 2, line 39 - column 3, line 41; claim 1; figures 1,2 *	1,4,7	
A	IBM TECHNICAL DISCLOSURE BULLETIN., vol.25, no.5, October 1982, NEW YORK US page 2340 RIECKHOFF 'SEMICONDUCTOR WAFER WET PROCESSING ROTATING APPARATUS' * the whole document *	1,3,4	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H01L
Place of search		Date of completion of the search	Examiner
THE HAGUE		18 November 1994	Rieutort, A
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